# ES. EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (Corps) has prepared this Biological Assessment (BA) for the Columbia River Channel Improvements Project (the Project) to evaluate potential effects on federally listed threatened and endangered salmonids that may be associated with proposed channel improvements[1]. The project is a multipurpose action consisting of navigation improvements and ecosystem restoration features. This BA was prepared as part of the biological consultation required under Section 7 of the Endangered Species Act (ESA). This reconsultation process was undertaken with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

## ES.1 Authorized Multipurpose Project

In December 1999, Congress authorized the deepening of the Columbia and Lower Willamette Rivers Federal Navigation Channel to 43 feet (Section 101(b)(13) of the Water Resource Development Act of 1999). The authorized plan would modify the existing federal navigation project for the Columbia and Willamette Rivers and provide for construction of ecosystem restoration features. This BA is for the Columbia River segment of the authorized project only.

Portions of the Lower Willamette River have been designated as a federal National Priorities List (NPL) site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Construction of the Willamette River features has been deferred pending study and selection of an appropriate remedy for cleanup under CERCLA. Following selection of the remedy, the Willamette River features will be re-evaluated and a separate Section 7 consultation will be done.

Details of the proposed actions to be undertaken are summarized in Section 3 of this BA. The location of the proposed project activities will be limited to dredging selected areas from River Mile (RM) 3, near the mouth of the Columbia River, to RM 106.5, near the I-5 bridge in Portland; disposing of dredged material in selected pre-approved upland and shoreline locations; and disposing of dredged material in selected flowlane and ocean locations.

Because significant reaches of the Lower Columbia River and navigation channel are naturally deeper than 43 feet, only specific areas that are currently less than 43 feet deep will require dredging. The shallower reaches that would be subject to deepening activities represent approximately 3.5 percent of the total river area between RM 3 and RM 106.5, or 54 percent of the existing navigation channel.

Ecosystem restoration features identified as part of the authorized Project include the use of a combined pump/gravity water supply for restoring wetland and riparian habitat at Shillapoo Lake (RM 91); tidegate retrofits for salmonid passage installed at selected locations along the lower Columbia River; and construction of connecting channels at the upstream end of Walker-Lord and Hump-Fisher Islands to improve access to embayments and rearing habitat for juvenile salmonids.

Environmental mitigation features proposed to offset wetland and riparian losses resulting from upland disposal are also included in the authorized project. These features will be developed on a total of 740 acres of land located at the Martin Island (RM 80), Woodland Bottoms (RM 81), and Webb (RM 47) mitigation sites. The Woodland Bottoms and Webb mitigation sites are located behind flood control dikes and are not connected to the Columbia River except through pump stations and tidegates. The actions to implement those features will occur behind existing dikes that have created a barrier between the sites and

[1] The BA also addresses Lower Columbia River/Southwest Washington coho (candidate for listing) and Coastal cutthroat trout (proposed for listing as threatened).

the listed species and their habitat. Accordingly, these actions will not affect the indicators or pathways in the conceptual model or adversely modify critical habitat.

## ES.2 ESA Consultation

Section 7 of the ESA of 1973 requires that federal agencies "insure" that their actions are "not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical] habitat" [16 USC Section 1536 (a)(2)]. NMFS and USFWS share responsibility for the administration of the ESA, and federal agencies must consult with NMFS and USFWS if their activities could affect listed species or their habitat.

A BA is prepared to "evaluate the potential effects of the action on listed and proposed species and designated and proposed critical habitat" (50 CFR Section 402.12). In preparing a BA, the federal agency (in this instance the Corps) uses the best available scientific information to evaluate the potential effects of the action on listed species within the action area. Based on the effects that are identified through this process, the federal agency will determine whether formal consultation is necessary. When the federal agency completes its BA, it is submitted to NMFS and/or USFWS for review and consultation on whether the action will jeopardize the continued existence of the listed species or result in the destruction or adverse modification of their critical habitat. NMFS and/or USFWS document their findings and recommendations in a Biological Opinion (BO).

A consultation on terrestrial species was completed in December 1999 and was not reinitiated. The terrestrial species addressed in that BA are listed in Table ES-1.

**Table ES-1: Listed USFWS Plant and Wildlife Species (addressed in the 1997-99 Consultation)**

| Species | Status |
|---|---|
| Columbia white-tailed deer (*Odeocoileus virginianus leucurus*) | Endangered |
| Marbled murrelet (*Brachyramphus marmoratus*) | Threatened |
| Western snowy plover (*Charadrius alexandrinus nivosus*) | Threatened |
| Brown pelican (*Pelecanus occidentialis*) | Endangered |
| Oregon silverspot butterfly (*Speyeria zerene hippolyta*) | Threatened |
| Water howellia (*Howellia aquatilis*) | Threatened |
| Golden Indian paintbrush (*Castilleja levisecta*) | Threatened |
| Bradshaw's lomatium (*Lomatium bradshawii*) | Endangered |
| Nelson's checkermallow (*Sidalcea nelsoniana*) | Threatened |
| Bald eagle (*Haliaeetus leucocephalus*) | Threatened-Proposed Delisting |
| Aleutian Canada goose (*Branta canadensis leucopareia*) | Delisted – Currently Monitored |
| Peregrine falcon (*Falco peregrinus*) | Delisted – Currently Monitored |

In the Columbia, Willamette, and Snake Rivers, several fish species are listed as threatened and endangered under the ESA. This BA was prepared by the Corps in response to NMFS's request to reinitiate consultation on listed species potentially affected by the Project. ESA consultation may be reinitiated if new information reveals potential effects to listed species not previously considered during an earlier consultation (50 CFR Section 402.16). This BA addresses 15 fish populations. It includes 13 listed populations, 1 population proposed for listing, and 1 candidate population, which are listed in Table ES-2. Thirteen of these 15 fish populations were evaluated during the previous consultation process.

**Table ES-2: Fish Populations Addressed in This Biological Assessment**

| Responsible Agency | Species | Listing Status |
|---|---|---|
| NMFS | Snake River fall chinook salmon (*Oncorhynchus tshawytscha)*[1] | Threatened |
| | Snake River spring/summer chinook salmon (*Oncorhynchus tshawytscha*)[1] | Threatened |
| | Snake River sockeye (*Oncorhynchus nerka*) [1] | Endangered |
| | Snake River steelhead (*Oncorhynchus mykiss*) [1] | Threatened |
| | Upper Willamette River chinook *(Oncorhynchus tshawytscha*) [1] | Threatened |
| | Upper Willamette River steelhead (*Oncorhynchus mykiss*) [1] | Threatened |
| | Upper Columbia River steelhead (*Oncorhynchus mykiss*) [1] | Endangered |
| | Lower Columbia River steelhead (*Oncorhynchus mykiss*) [1] | Threatened |
| | Lower Columbia River chinook salmon (*Oncorhynchus tshawytscha*) [1] | Threatened |
| | Upper Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) [1] | Endangered |
| | Columbia River chum salmon (*Oncorhynchus keta*) [1] | Threatened |
| | Middle Columbia River steelhead (*Oncorhynchus mykiss*) [1] | Threatened |
| USFWS | Bull trout (*Salvelinus confluentus*) | Threatened |
| | Coastal cutthroat (*Oncorhynchus clarki clarki*) [1] | Proposed Threatened |
| NMFS | Lower Columbia River/Southwest Washington coho[2] (*Oncorhynchus kisutch)* | Candidate |

[1] Species previously addressed in the earlier BA and supplements.

[2] On July 25, 1995, NMFS designated this coho evolutionary significant unit (ESU) as a candidate for listing. Although not officially listed as threatened or endangered under the ESA, coho are included here because federal agencies have the responsibility to consider potential effects from the proposed Project on candidate species for planning purposes.

The goals of the reconsultation that the Services and the Corps have mutually developed are a re-evaluation of potential project effects; an analysis of these potential effects within the framework of an ecosystem-based conceptual model; and development of compliance measures and monitoring conditions based on the effects analysis. In addition, the six Sponsor Ports—Portland and St. Helens, Oregon and Kalama, Longview, Vancouver, and Woodland, Washington—have assisted the Corps as a non-federal representative for both NMFS and USFWS consultations (see Corps letters dated October 16, 2000; October 27, 2000; May 21, 2001; and July 11, 2001, Appendix A).

As part of the ESA consultation process, additional ecosystem restoration features, adaptive management approaches, and monitoring were identified. These are discussed in further detail in later sections of this executive summary.

## ES.3 Independent Scientific Review

To facilitate the overall goals of reconsultation, the Corps, the Services, and the Sponsor Ports retained Sustainable Ecosystems Institute (SEI), a public-benefit, science mediation group, to help frame scientific questions raised in connection with the proposed Project and identify best available science. SEI assembled a panel of seven nationally prominent technical experts to provide an independent, scientific, peer-review process to evaluate the potential environmental issues surrounding improvement of the navigation channel. For further information regarding the panel, see Appendix A. Summaries of the SEI public workshops, the technical presentations delivered at the workshops, and the panel's summary report of the findings are available on the SEI Columbia River project website, *http://www.sei.org/columbia/home.html.*

In addition, since early spring 2001, the Corps, NMFS, USFWS, and the Sponsor Ports have engaged in regular reconsultation meetings to address technical issues associated with the proposed project and its

potential effects and have conducted additional modeling for the estuary. Modeling analysis was done by both the Oregon Health and Science University/Oregon Graduate Institute (OHSU/OGI) and the Corps' Waterways Experiment Station (WES). The results of these modeling efforts are included in Appendices F and G.

## ES.4 Action Area Analyzed

The NMFS, USFWS, and the Corps have agreed to define the study area broadly for the Project BA. The action area is defined to extend beyond the actual location of proposed activities to include areas that may potentially be directly or indirectly affected by the Project (50 CFR § 402.02). The action area includes the following:

- A bank-to-bank run of the Columbia River from Bonneville Dam down to the river's mouth, and from the river mouth extending 12 miles out into the Pacific Ocean in a fan shape. This area includes adjacent port terminals and berths and certain ecosystem restoration and mitigation sites.

- Upland disposal, ecosystem restoration, and mitigation sites.

All potential direct and indirect effects resulting from project activities in the action area are addressed in this analysis, as are effects from interrelated and interdependent activities. Although 11.6 miles of the lower Willamette River area were addressed in the original FEIS and included in the Congressional authorization, the Willamette River is not included in this BA. It will be addressed in a separate BA after resolution of sediment cleanup issues associated with its designation as a federal NPL site under the CERCLA.

For purposes of discussion, the action area has been divided into three general habitat or reach types. The first is riverine, which begins at Bonneville Dam and runs downstream to the start of the estuary at approximately RM 40. The second is estuarine and runs from RM 40 downstream to RM 3. The third is the river mouth, which starts at a wide area at RM 3 and encompasses the outer boundary of the Deep Water Site (approximately 12 miles beyond RM 3) in a fan shape.

Future requirements before construction will start on this Project include Section 401 Clean Water Act (CWA) certification and Coastal Zone Management Act (CZMA) determination for both Oregon and Washington, and a Record of Decision under NEPA. The Corps intends to supplement the NEPA document, completed in August 1999, to incorporate modifications to the proposed action described in this BA.

## ES.5 Environmental Setting

The Columbia River is naturally a very dynamic system. It has been affected and shaped over eons by a variety of natural forces, including volcanic activity, storms, floods, natural events, and climatological changes. These forces had and continue to have a significant influence on biological factors (e.g., flow), habitat, inhabitants, and the whole riverine and estuarine environment of the Columbia River.

Over the past century, human activities have dampened the range of physical forces in the action area and resulted in extensive changes in the lower Columbia River and estuary. Effects that have been particularly large have occurred through changes to flow hydrographs, isolation of the floodplain, and diking and filling of wetland areas. Probably the greatest changes from human activity that influence the Lower Columbia River system have been the reduction of the peak seasonal discharges and changes in the velocity and timing of flows as a result of water storage by large dams. Flow regulation that began in the 1970s has reduced the 2-year flood peak discharge at The Dalles from 580,000 cfs to 360,000 cfs (Corps, 1999a).

These physical changes also affect other factors in the riverine and estuarine environment. Tides raise and lower river levels at least 4 feet and up to 12 feet twice every day. The historical range for tides was probably similar, but seasonal ranges and extremes have certainly changed because of flow regulation. The salinity level in areas of the estuary can vary from zero to 34 parts per thousand (ppt) depending on tidal intrusion, river flows, and storms. Flow regulation has affected the upstream limit of salinity intrusion. The salinity wedge is believed to have ranged from the river mouth to as far upstream as RM 37.5 in the past. It is now generally believed that the salinity ranges between the mouth and RM 30. The river bed is composed of a continuously moving series of sand waves that can migrate up to 20 feet per day at flows of 400,000 cfs or greater, and at slower rates at lesser flows. As noted above, this flow rate is not experienced as often as it was prior to flow regulation in the Columbia River. Turbidity is also a function of river discharge. For most of the year, turbidity levels are below 10 nephelometric units (NTU). Turbidity levels over 20 NTUs have occurred during high winter flows in the river and ranged from 60 to 75 NTUs during the 1996 flood. These ranges of turbidity levels are the same as the historical ranges, but do not occur as often.

The environmental conditions in the Lower Columbia River are important to listed salmonid populations. These environmental conditions collectively influence the growth and survival of the salmonid species rearing in and migrating through the Lower Columbia River. The historical environmental conditions of the river, prior to nonindigenous human influence, were considerably different from existing environmental conditions. Because these differences are important in assessing the potential for natural variability and the significance of incremental changes within the river ecosystem, both the historical and existing conditions are presented and discussed separately.

## ES.6 Proposed Action Subject to This Consultation

The proposed action subject to this consultation includes those elements identified in the authorized project as well as additional elements identified through the reconsultation process. The authorized project is described below:

- The existing 600-foot-wide, 40-foot-deep navigation channel would be deepended from -40 feet to -43 feet Columbia River Datum (CRD), from RM 3 to RM 106.5 on the Columbia River, including advanced maintenance dredging for overwidth and overdepth in the reaches where this practice is currently performed in the maintenance program.

- Three of the existing five turning basins on the Columbia River (located at RM 15, 73.5, and 101.5, respectively) would be deepened to -43 feet CRD.

- A total of 29 upland disposal sites (with a total land area of 1,681 acres), three beach nourishment sites, and one ocean disposal site would be required for the disposal of construction materials and subsequent channel maintenance dredged material. Fourteen of the upland disposal sites, totaling 1,025 acres, are currently in use, as are the three beach nourishment sites. Detailed descriptions of these sites are located in Appendix C.

- Ecosystem restoration features include the use of a combined pump/gravity water supply for restoring wetland and riparian habitat at Shillapoo Lake. Tidegate retrofits with fish slides for salmonid passage would be installed at selected locations along the lower Columbia River. Connecting channels would be constructed at the upstream end of Walker-Lord and Hump-Fisher Islands to improve fish access to embayment rearing habitat for juvenile salmonids.

- Environmental mitigation features would be constructed on a total of 740 acres of land located at the Woodland Bottoms, Martin Island, and Webb mitigation sites.

The authorized project has been modified to include additional ecosystem restoration features. The Corps will supplement the NEPA document to include these modifications.

## ES.7 Conceptual Model for Analysis

A conceptual model was constucted of the Lower Columbia River ecosystem relationships that are significant for salmonids. Because the habitat requirements of adult salmonids are limited in the lower Columbia River, the model focuses on juvenile salmonids. The conceptual model incorporates the best available science for adult and juvenile salmonids. The basic habitat-forming processes—physical forces of the ocean and river—create the conditions that define habitats. The habitat types, in turn, provide an opportunity for the primary plant production that gives rise to complicated food webs. All of these pathways combine to influence the growth and survival and, ultimately, the production and ocean entry of juvenile salmonids moving through the lower Columbia River.

## ES.8 Effects Analysis

The conceptual model was used to evaluate potential effects from the proposed Project. The effects analysis focuses on changes in ecosystem indicators of function to clarify how the proposed Project may influence listed salmonid rearing, successful ocean entry, and return migration. It also clarifies influences on critical habitats and the related processes where small, indirect changes may influence ecosystem functions in the long term.

The analysis addresses the Project's potential to change each of the 38 ecosystem indicators that are part of the conceptual model. It then looks at how any potential changes in indicators could potentially effect ecosystem functions related to salmonids such as habitat forming processes, habitat types, primary productivity, the food web, growth, and survival. Finally, the analysis looks at how these ecosystem functions potentially could effect the salmonids that are the subject of this BA.

The following is a summary of some of the effects identified as part of the analysis. It is important to note that, given the natural variability of the river system, many of the effects on pathways are expected to be well within that natural variability and, consequently, are not expected to negatively affect salmonids or their habitat.

- There will be short-term, localized increases in suspended sediment concentrations in the immediate vicinity of dredging and disposal operations. There may be as much as a 4.5 percent increase in the total suspended sediment load in the lower Columbia River as a result of the Project. Increased suspended sediment levels would tend to improve habitat-forming processes in the estuary by providing additional materials to form tidal marsh and swamp habitat. However, the increased suspended sediment load is likely too small to have a measurable effect on habitat-forming processes.

- The Project may temporarily shift the direction of bedload movement along the sides of the navigation channel as a result of side-slope adjustments, which may cause erosion at some previous beach nourishment sites. The proposed Project will result in some side-slope adjustment as a result of altered bedload transport direction within the action area. This process will not affect water column or tidal marsh and swamp habitats. The side-slope adjustment process will take 5 to 10 years. Over that time shallow water and flats habitat at six historical shoreline disposal sites will tend to move shorewards into former areas of artificial beach that have slowly eroded. All of these shoreline sites have been used in the past for dredge disposal. Because the bedload transport rate during side-slope adjustment is the same rate at which normal bedload transport would occur without the Project (just in a different direction), the quantity and quality of shallow water and flats habitat is expected to

remain constant in the river and estuary reaches. The historical beach nourishment sites do not contain many of the important habitat features that shallow water habitats used by salmonids typically include, such as low velocity, vegetation, and food sources.

- There will be short-term, localized increases in turbidity levels in the immediate vicinity of dredging and disposal operations. Short-term localized turbidity levels of 5 to 26 NTUs that might be caused by the proposed action are not likely to produce detectable effects on plant growth in the lower river. Not only is the amount of increase too low, but it will be localized to areas where dredging and disposal will occur.

- Salinity increases of less than 0.5 ppt in the shallow embayments of the estuary (e.g., Cathlamet Bay, Grays Bay) will occur. Salinity increases up to 5 ppt would occur in the bottom of the navigation channel. The computed differences in modeling between base and plan for salinity in shallow areas are much smaller than natural temporal variations due to normal variations in freshwater flow and tidal dynamics. Differences computed for the channel bottom are increases up to 5 ppt. This will not affect habitat-forming processes in any of the three habitat types.

- The salinity wedge could potentially be shifted upstream up to a mile in the bottom of the navigation channel. To the extent that the estuary turbidity maximum (ETM) mimics the salinity, the ETM could shift up to one mile. The potential shift of the ETM would occur in a relatively small part of the south channel. It would generally remain within the current range or path of the ETM, with up to a 1-mile shift in the upstream boundary. This change is smaller than the existing fluctuations caused by flow conditions of about 9 miles. The ETM suspends nutrients in the estuary, which are then distributed by tides and currents in the river system. Any fluctuation in the location of the ETM that may result from the Project is not expected to affect the tidal influences and currents that distribute nutrients throughout the estuary. The effect of the potential shift of the ETM on distribution of nutrients in the estuary is expected to be so small that it cannot be measured.

- Bathymetric changes will include up to 3 feet of deepening in areas of the navigation channel that are currently shallower than -48 ft CRD and some rise in the riverbed at shoreline and flowlane disposal sites. In addition, there is a potential for zero to 3 feet of deepening along the side slopes adjacent to the dredge cuts. Water surface elevation could be affected between RM 80 and RM 146. The decrease could be as much as 0.18 foot at the upstream end of the Project. The 3-foot lowering of the channel bathymetry will occur in 56 percent of the navigation channel. This is not expected to directly impair habitat-forming processes because the increase in water depth will be limited to the area of the navigation channel that will add 3 feet to the water column type of habitat. Flowlane disposal will occur in water column habitat.

- Shoreline disposal could potentially disturb and shift the location of shallow water habitat at three proposed deposit sites: Sand Island, Miller Sands, and Skamokawa Beach. The historical beach nourishment sites do not contain many of the important habitat features that shallow water habitats used by salmonids typically include, such as low velocity, vegetation, and food sources.

- Water column habitat will be directly affected by the increased depth (approximately 3 feet) of the water column within a portion of the navigation channel in the action area

- Water column habitat may be affected by drilling and blasting activities. Blasting will be done during the preferred in-water work window. This is the period when salmonid abundance is lowest and will minimize impacts to the listed populations. In addition, since there may be some fish in the river, the blasting plan will be designed to further minimize any impacts by keeping over pressures above the

blast zone to less than 10 psi. This level is generally believed to be below the level at which salmonids would be adversely affected. A state-approved plan for blasting will also be developed to further minimize impacts. Based on the above, the potential impacts to water column habitat will be minimized.

- Dredging and disposal actions will result in loss of adult and juvenile mobile macroinvertebrates. Some mortality of mobile macroinvertebrates by dredging and disposal operations will occur; however, this mortality is expected to have an insignificant effect on these populations in either the estuary or the river mouth. Mobile macroinvertebrates are adapted to respond rapidly to disturbances, and to re-colonize areas following these disturbances. Mobile macroinvertebrates can be an important food item for salmonids in estuaries. Changes in mobile macroinvertebrate populations resulting from project actions are not anticipated to be large enough to affect the salmonid food web.

Although none of the identified indicator changes discussed above is believed to have a measurable effect on existing habitat types, the Corps is proposing to implement compliance measures to ensure effects will be minimized and will also monitor to confirm this conclusion. In addition, benficial effects from ecosystem restoration and research actions can be found in ES.11.1 and ES.11.2.

## ES.9 Long-Term Effects

During the reconsultation process, concerns have been identified regarding potential long-term effects of the Project. These have centered on minor changes that may be caused by Project actions that are not detectable in the short term, but may affect listed salmonid habitat over the next 50 years. This could also include ecosystem effects that are not identifiable given the current understanding of the ecosystem. Areas for which concern has been expressed during this reconsultation include those related to the ETM, formation and preservation of tidal marsh and swamp habitats, habitat opportunity changes in isolated geographic areas, and elimination of connectivity between habitats relied on by juvenile salmonids.

The Corps recognizes that this is an issue that needs to be addressed by this BA. Table ES-6 lists actions to gather information that will be used to address effects that are not detectable in the short-term. Table ES-8 contains actions that will address ecosystem research that is aimed at advancing the knowledge base for the recovery of the listed salmonids. This research may result in identification of effects that are not currently understood, given the current knowledge of the ecosystem.

None of the identified potential effects are anticipated to measurably affect salmonids; however, there is uncertainty associated with ecosystem processes that warrants implementing specific impact minimization, monitoring, and research actions.

## ES.10 Compliance Actions

Compliance actions are those actions that will be taken during the implementation of project actions to avoid or minimize potential effects on listed and candidate salmonid species. These compliance measures prescribe safeguards, techniques, and guidelines that will minimize effects. Tables ES-3, ES-4 and ES-5 address BMPs for project disposal and dredging actions, as well as timing restrictions associated with these actions. The proposed construction dredging to deepen the Columbia River Channel to 43 feet would require approximately 2 years of year-round dredging. Some activity would be occurring during the entire period, as shown in Table ES-3. Year-round dredging is proposed at depths greater than 20 feet because salmonids generally are not present in these locations.

These compliance actions have been developed over time through the Corps' dredging program; they are considered to represent the best management practices for dredging and disposal to minimize any adverse effect to listed species or their habitat. These actions will be monitored by onsite inspection under

established quality assurance processes. If the inspection identifies new information that potentially warrants a change, that information will be reported to the adaptive management team for consideration of changes to the compliance measures.

**Table ES-3: Dredging Timing**

| Construction Features | Type of Dredging | Timing |
|---|---|---|
| Navigation channel, including overdepth and overwidth dredging at depths greater than 20 feet | Hopper<br>Pipeline<br>Mechanical excavation | No timing windows<br>No timing windows<br>No timing windows |
| Turning basins at depths greater than 20 feet | Hopper<br>Pipeline | No timing windows<br>No timing windows |
| Rock removal with blasting | Mechanical excavation | November 1 to February 28 |
| Rock removal at depths greater than 20 feet | Mechanical excavation | No timing windows |
| Berths | Mechanical excavation | November 1 to February 28 |
| Ecosystem restoration features dredging at depths greater than 20 feet | Mechanical excavation<br>Pipeline<br>Hopper | No timing windows |
| Ecosystem restoration features dredging at depths less than 20 feet | Mechanical excavation<br>Pipeline<br>Hopper | November 1 to February 28 |

**Table ES-4: Minimization Practices and Best Management Practices for Dredging**

| Monitoring Action Number | Indicator | Measure | Justification | Duration | Management Decision |
|---|---|---|---|---|---|
| **Hopper Dredging** | | | | | |
| CA-1 | Entrainment (Survival) Benthic Invertebrates Deposit Feeders | Maintain dragheads in the substrate or no more than 3 feet off of the bottom with the dredge pumps running. | This restriction minimizes or eliminates entrainment of juvenile salmonids during normal dredging operations. | Continuous during dredging operations. | Maintain until new information becomes available that would warrant change. |
| CA-2 | Habitat Complexity<br>Bathymetry & Turbidity<br>Feeding Habitat Opportunity<br>Suspension-Deposit Feeders<br>Deposit Feeders<br>Mobile Macroinvertabrates | Dredge in shallow water areas (less than 20 feet) only during the recommended ESA in-water work period for the Columbia River of November 1 until February 28. | Areas less than 20 feet deep are considered salmonid migratory habitat. Dredging or disposal in these areas could delay migration or reduce or eliminate food sources. | Continuous during dredging operations. | Maintain until new information becomes available that would warrant change. |
| **Pipeline Dredging** | | | | | |
| CA-3 | Entrainment (Survival) Benthic Invertebrates Deposit Feeders | Maintain cutterheads in the substrate or no more than 3 feet off of the bottom with the dredge pumps running. | This restriction minimizes or eliminates entrainment of juvenile salmonids during normal dredging operations. | Continuous during dredging operations. | Maintain until new information becomes available that would warrant change. |
| CA-4 | Habitat Complexity<br>Bathymetry & Turbidity<br>Feeding Habitat Opportunity<br>Suspension-Deposit Feeders<br>Deposit Feeders<br>Mobile Macroinvertabrates | Dredge in shallow water areas (less than 20 feet) only during the recommended ESA in-water work period for the Columbia River of November 1 until February 28. | Areas less than 20 feet deep are considered salmonid migratory habitat. Dredging or disposal in these areas could delay migration or reduce or eliminate food sources. | Continuous during dredging operations. | Maintain until new information becomes available that would warrant change. |
| **General Provisions For All Dredging** | | | | | |
| CA-5 | Contaminants<br>Water Column Habitat | The contractor will not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway. | Protect water resources. | Life of contract or action. | If material is released, it will immediately be removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground will be excavated and removed, and the area restored as directed. Any in-water release will be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response. |
| CA-6 | NA | The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal of this material will be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177. | Dispose of hazardous waste. | Life of contract or action. | If material is released, it will immediately be removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground will be excavated and removed, and the area restored as directed. Any in-water release will be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response. |

## Table ES-5: Best Management Practices for Disposal

| Monitoring Action Number | Indicator | Measure | Justification | Duration | Management Decision |
|---|---|---|---|---|---|
| **Flow Lane Disposal** | | | | | |
| CA-7 | Accretion/Erosion | Dispose of material in a manner that prevents mounding of the disposal material. | Spreading the material out will reduce the depth of the material on the bottom, which will reduce the impacts to fish and invertebrate populations. | Life of contract or action. | Maintain until new information becomes available that would warrant change. |
| CA-8 | Bathymetry & Turbidity (Survival)<br>Suspended Solids | Maintain discharge pipe of pipeline dredge at or below 20 feet of water depth during disposal. | This measure reduces the impact of disposal and increased suspended sediment and turbidity to migration juvenile salmonids, as they are believed to migrate principally in the upper 20 feet of the water column. | Continuous during disposal operations. | Maintain until new information becomes available that would warrant change. |
| **Upland Disposal** | | | | | |
| CA-9 | Suspended Solids<br>Turbidity (Survival)<br>Bathymetry & Turbidity | Berm upland disposal sites to maximize the settling of fines in the runoff water. | This action reduces the potential for increasing suspended sediments and turbidity in the runoff water | Continuous during disposal operations. | Maintain until new information becomes available that would warrant change. |
| CA-10 | Habitat Complexity,<br>Connectivity<br>Conveyance<br>Insects<br>Resident Macrodetritus,<br>Microdetritus<br>Large Woody Debris | Maintain 300-foot habitat buffer. | Maintains important habitat functions. | Life of contract or action. | Maintain until new information becomes available that would warrant a change. |
| **Shoreline Disposal** | | | | | |
| CA-11 | Habitat Complexity<br>Bathymetry & Turbidity<br>Feeding Habitat Opportunity<br>Suspension-Deposit Feeders<br>Deposit Feeders<br>Mobile Macroinvertabrates | Dispose of in shallow water areas (less than 20 feet) only during the recommended ESA inwater work period for the Columbia River of November 1 until February 28. | Areas less than 20 feet deep are considered salmonid migratory habitat, Dredging or disposal in these areas could delay migration or reduce or eliminate food sources. | Continuous during disposal operations. | Maintain until new information becomes available that would warrant change. |
| CA-12 | Stranding | Grade disposal site to a slope of 10 to 15 percent, with no swales, to reduce the possibility of stranding of juvenile salmonids. | Ungraded slopes can provide conditions on the beach that will create small pools or flat slopes that strand juvenile salmonids when washed up by wave action. | Continuous during disposal operations. | Maintain until new information becomes available that would warrant change. |

| Monitoring Action Number | Indicator | Measure | Justification | Duration | Management Decision |
|---|---|---|---|---|---|
| **Ocean Disposal** | | | | | |
| CA-13 | N A | Dispose of in accordance with the site management and monitoring plan, which calls for a point dump placement of any material from the project during construction. The plan is to place any construction material in the southwest corner of the deep water site. | This action minimizes conflicts with users and impacts to ocean resources. | Continuous during dredging operations. | Maintain until new information becomes available that would warrant change. |
| **General Provisions For All Disposal** | | | | | |
| CA-14 | N A | Dispose of hazardous waste. | The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal of this material will be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177. | Life of contract or action. | If material is released, it will immediately be removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground will be excavated and removed, and the area restored as directed. Any in-water discharge will be immediately reported the nearest U.S. Coast Guard Unit for appropriate response. |

**Table ES-6: ESA Sec. 7(a)(2) Monitoring Actions Associated with Dredging and Disposal**

| Monitoring Action Number | Indicator | Monitoring Task | Justification | Uncertainty And Risk[1] | Duration | Data Analysis | Trigger For Management Changes |
|---|---|---|---|---|---|---|---|
| MA-1 | Salinity, velocity, water surface, habitat complexity, connectivity, and conveyance, and habitat opportunity. | The Corps will maintain three hydraulic monitoring stations, one downstream of Astoria, one in Grays Bay, and one in Cathlamet Bay. Parameters measured would include salinity, water surface, and water temperature. | Physical changes related to channel deepening are expected to be small and concentrated near the navigation channel. | Salinity L,L+; velocity L,L; bathymetry L,M-; habitat complexity, connectivity, and conveyance L+, M; | 7 years: 2 years before, 2 years during, and 3 years after construction | An analysis would be conducted to determine pre- and post-project relationships among flow, tide, salinity, water surface, and temperature. | Post-project data exceeds defined threshold values. Determine if task should continue and what funding source is appropriate. |
| MA-2 | Dredging volume, bedload. | Annual dredging volumes, construction and O&M. | To ensure scale of the project does not change. | Bedload M, L | Life of the project. | Actual volumes will be compared to predicted. | Dredging volumes exceed capacity of the disposal plan. |
| MA-3 | Accretion/erosion, bathymetry (main channel). | Main channel bathymetric surveys throughout project area. | Side-slope adjustments are expected to occur intermittently adjacent to the navigation channel. | Accretion/erosion M, L; bathymetry L, M-. | 7 years: 2 years before, 2 years during, and 3 years after construction | Bathymetric changes will be tracked to determine if habitat is altered. | Habitat alteration in main channel due to side-slope adjustment. |
| MA-4 | Tidal marsh, swamp, flats, refugia, habitat complexity, connectivity and conveyance, suspension and deposit feeders, insects, macrodetritus and habitat specific food availability, juvenile salmonids in peripheral habitats and habitat opportunity. | Repeat estuary habitat surveys being conducted by NMFS (Bottom and Gore, 2001 proposal). | Identify if there is a change to habitat due to deepening. | Tidal marsh and swamp habitat M, L+; flats habitat M, M-L+; suspension/deposit feeders M, M; deposit feeders M, M; suspension feeders M, M; insects H, M: macrodetritus H, L+; habitat-specific food availability M, M; feeding habitat opportunity L, L+ | One time survey conducted 3 years after completion of the deepening. | Habitat mapping from aerial photos and ground surveys. | Changes to individual habitat types that are based on defined threshold values. Determine need for other surveys. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MA-5 | Contaminants | NMFS will review the SEDQUAL database to determine if there are areas that would require additional sampling. Review existing contaminants database using NMFS guidelines or trigger values that are more protective of salmonids and trout. Provide notification during construction dredging to monitor for presence of fine-grained material – i..e., oily sheens. If found, dredging will cease in that location and additional testing will be conducted. | Ensure that channel construction does not disturb undetected deposits of fine-grained material, potentially causing redistribution of contaminants that could pose a risk to salmonids and trout. | Contaminants M, M. | NMFS will review SEDQUAL data prior to construction; if additional samples are required they would be obtained prior to construction. On-board observations would be conducted. | Existing sediment data will be reviewed for the amount of fine-grained material. Chemical results will be compared to the NMFS guideline for the protection of salmon. | Detection of chemicals at concentrations that pose a risk to the health and/or survival of salmonids or trout. |
| MA-6 | Stranding | Field surveys will be made monthly at selected beaches (upper, mid, and lower river) during the April-August out-migration to measure the number of fish being stranded along beaches. | Identify if there is a change in stranding due to deepening. | Stranding L, M. | One year before deepening and 1 year after deepening. | Compare pre- and post-project stranding counts. | If there is an increase in the number of fish stranded, proposals would be developed and presented to decision makers. |

## ES.11 Ecosystem Restoration and Research

In addition to the ecosystem restoration in the authorized project, six ecosystem restoration features were added to the Project during the reconsultation process. One mitigation feature that would benefit salmonids, Martin Island Embayment, is a part of the authorized project. Ecosystem research actions are also part of the proposed Project. These actions are taken by the Corps as part of the proposed Project to assist the efforts of the Corps, the Services, and others in the broader issues of understanding the lower Columbia River ecosystem.

### *ES.11.1 Ecosystem Restoration Features*

Restoration features will be done by the Corps under this BA to create or improve salmonid habitat, specifically tidal marsh/swamp, riparian forest, shallow water and flats, and backwater/slough habitat. In addition to the three original restoration features proposed in the 1999 FEIS, the Corps proposes to implement six more restoration features. The Corps, the Services, and the Sponsoring Ports have agreed to add ecosystem restoration features to the Project. These features were selected based upon the type, function, and value of habitat that would benefit the listed populations. It was agreed that type, function, and value were more important than total acres restored. The original restoration features, as well as the additional features, are listed in Table ES-7. The table also lists the type, function, and value of each restoration feature.

The types of habitat to be restored include tidal marsh and swamp habitat, shallow water and flats habitat, backwater/side channel reconnection to the Columbia River, tributary reconnection to the Columbia River for spawning and riparian forest.

The functions include providing rearing habitat, increased detrital export, increased benthic invertebrate productivity, and improved access for adult salmonids to headwaters for spawning.

The value of these restoration features to the populations ranges from moderate to high.

### *ES.11.2 Ecosystem Research Actions*

These research actions address indicators of the salmonid conceptual model where additional studies would provide useful information to the recovery of the species. Six ecosystem research actions have been identified that will contribute to the overall knowledge base for some important indicators for salmonids. These indicators include tidal marsh and swamp habitat, shallow water and flats habitat, water column habitat, bathymetry, contaminants, salinity, turbidity, and phytoplankon. The research will begin prior to construction and continue up to 3 years after construction. These research actions will advance the knowledge base for the recovery of the species. The annual and cumulative results will be presented to the Adaptive Management Team.

Research actions proposed for the Project are shown in Table ES-8. This table identifies the ecosystem research actions that the Corps proposes to implement under this BA.

**Table ES-7: Ecosystem Restoration Features for the Project**

| Feature | Area Affected by Restoration (acres) | Type, Function, and Value |
|---|---|---|
| Lois Island Embayment Habitat Restoration | 389 | Type: Tidal marsh and swamp; shallow water and flats habitat<br>Function: Provide rearing habitat for ocean-type salmonids; increase detrital export<br>Value: High |
| Purple Loosestrife Control Program | 300 | Type: Tidal marsh and swamp<br>Function: Maintain native Tidal marsh plant community; increase detrital export<br>Value: High |
| Miller/Pillar Habitat Restoration | 161 | Type: Shallow water and flats habitat<br>Function: Provide rearing habitat for ocean-type salmonids; increase benthic invertebrate productivity<br>Value: High |
| Tenasillahe Island Interim Restoration[1] (Tidegate/Inlet Improvements) | 92 | Type: Backwater/side channel reconnection to Columbia River<br>Function: Increase access/egress for ocean-type salmonids<br>Value: Moderate |
| Tidegate Retrofits for Salmonid Passage | 38 miles | Type: Tributary reconnection to Columbia River<br>Function: Increase access/egress for ocean-type salmonids; improve access for adult salmonids to headwaters for spawning<br>Value: High |
| Walker/Lord and Hump/Fisher Islands Improved Embayment Circulation | 335 | Type: Marsh and swamp; shallow water and flats habitat<br>Function: Provide rearing habitat for ocean-type salmonids; increase benthic invertebrate productivity<br>Value: Moderate |
| Martin Island Embayment | 32 | Type: Tidal marsh and swamp (wildlife mitigation)<br>Function: Increase detrital export; provide rearing habitat for ocean-type salmonids<br>Value: Moderate (salmonids); high (wildlife) |
| Cottonwood/Howard Island Proposal[2] Columbia White-Tailed Deer Introduction | 1,000 | Type: Translocation of Columbia white-tailed deer<br>Function: Establish secure, viable subpopulation of Columbia white-tailed deer<br>Value: High |
| Tenasillahe Island Long-Term Restorations[3] (Dike Breach) | 1,778 | Type: Tidal marsh and swamp; shallow water and flats habitat<br>Function: Provide rearing habitat for ocean-type salmonids; increase detrital export<br>Value: High |
| Bachelor Slough Restoration[4] | 300 (instream restoration)<br>6 (shoreline)<br>27 (riparian restoration) | Type: Shallow water and flats habitat; riparian forest<br>Function: Provide rearing habitat for ocean-type salmonids; increase detrital export<br>Value: Moderate (side channel); high (riparian forest) |
| Shillapoo Lake Restoration[5] | 1,250 acres | Type: Managed wetlands<br>Function: Increase waterfowl, shorebird, wading bird, and raptor habitat<br>Value: High |

Notes: The Tidegate Retrofits for Salmonid Passage, Walker/Lord and Hump/Fisher Islands Improved Embayment Circulation, and Shillapoo Lake Restoration features were proposed in the original FEIS (Corps, 1999a). The remaining restoration features were added during the BA reconsultation process.

[1]This restoration is contingent on hydraulic analysis results.

[2]This restoration primarily benefits Columbia white-tailed deer.

[3]This restoration feature is contingent on the delisting of Columbia white-tailed deer.

[4]This restoration feature is contingent on sediment testing and approval by WDNR.

[5]This restoration primarily benefits waterfowl, but would create detrital input to the Columbia River.

**Table ES-8: ESA Sec. 7(a)(1) Ecosystem Research Actions (ERA)**

| ERA Number | Indicator | Monitoring Task | Justification | Duration | Data Analysis | Management Decision |
|---|---|---|---|---|---|---|
| ERA-1 | Tidal Marsh and Swamp Habitat, Shallow Water and Flats Habitat, Water Column Habitat | Add one or two additional transects in different habitat types similar to those being done for the NMFS studies currently under way with AFEP | Provide additional habitat and salmonid distribution information for the estuary. Useful in establishing inventory information for future monitoring or restoration. | Begin before construction and for 3 years after completion of the project. | Record value and use of different habitat types for juvenile salmonids and cutthroat trout. | Determine if task should continue and what funding source is appropriate. |
| ERA-2 | Tidal Marsh and Swamp Habitat, Shallow Water and Flats Habitat, Water Column Habitat | Add upriver transect (upstream of RM 35) to evaluate cutthroat and juvenile salmonid use of the riverine area. | Little is known about the species use of this habitat. To provide additional information regarding salmonids use of this habitat. | Begin during construction and end 3 years after completion of the project. | Record value and use of different habitat types by juvenile salmonids and cutthroat trout. | Determine if task should continue and what funding source is appropriate. |
| ERA-3 | Bathymetry, Shallow Water and Flats Habitat | Conduct bank-to-bank hydrographic surveys of the estuary. | Has not been done in 20 years and is needed to assess available habitat and restoration actions. | Once, prior to construction. | Bathymetry will be available for shallow water areas in the estuary. | None required. |
| ERA-4 | Contaminants | In conjunction with ongoing studies of juvenile salmonids habitat utilization in the lower Columbia River collect and analyze juvenile salmonids and their prey for concentrations of chemical contaminants. | Provide additional data on contaminants in listed salmonids and their prey. Useful in establishing inventory information for future monitoring or restoration. | Begin before construction during and up to 3 years after construction, depending on the results. | Record concentrations of persistent contaminants (e.g., DDTs, PCBs, PAHs, dioxin-like compounds) in juvenile salmonids and prey. | Determine if task should continue and what funding source is appropriate. |
| ERA-5 | Contaminants | In conjunction with above contaminant study, assess sublethal effects of contaminants (e.g., growth, disease resistant) on salmonids. | Provide additional data for established contaminants thresholds effect levels to ensure that guidelines are protective of salmonids; to better characterize performance of juvenile salmonids in the estuary. | Begin before construction during and up to 3 years after construction, depending on the results. | Record health status of juvenile salmonids collected above. | Determine if task should continue and what funding source is appropriate. |
| ERA-6 | Salinity, turbidity, and phytoplankton | ETM Workshop | To further the knowledge of the ETM and the listed stocks. | Once | Not required | None required. |

Any study done should fit into the overall research effort that is being conducted or proposed by LCREP, NMFS, BPA and the Corps. In this way it will not be a duplication of effort will provide results that fit into what should be an overall goal for research in the estuary.

## ES.12 Adaptive Management Approach

The Corps recognizes that implementation of the proposed monitoring, compliance, restoration, and research actions will be most effective using an ecosystem approach that recognizes a multiplicity of scales. This will assist the other entities in the region involved in restoring the Columbia River estuary to advance the state of knowledge for salmonid recovery, make ecosystem improvements, and conduct research in a collaborative effort. The Corps, Sponsor Ports, and the Services will be the adaptive management team and will collaborate in decision making for changes to the Project. The Corps will perform the proposed actions using an adaptive management approach for the life of the Project. This approach is illustrated in Figure ES-1.

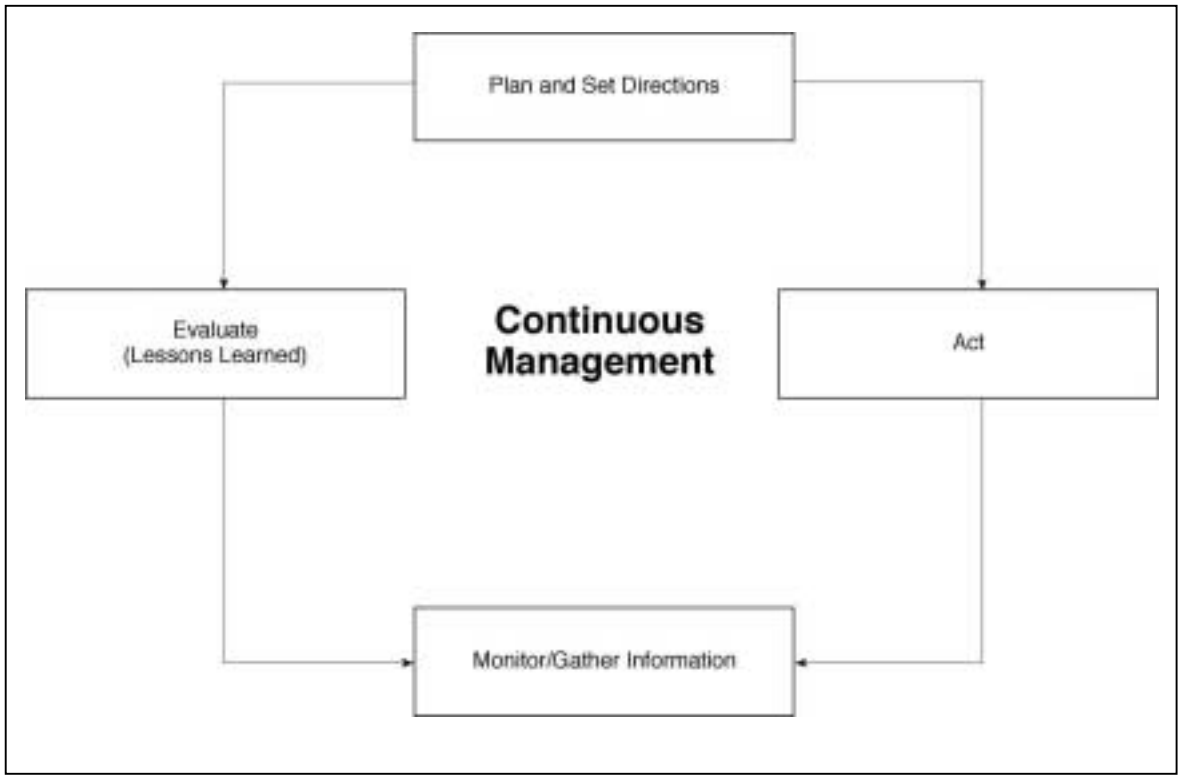


**Figure ES-1: Adaptive Management Approach**

An adaptive management team will track the compliance and monitoring efforts for the project. It will consist of staff from the Corps, NMFS, USFWS, and Sponsor Ports. It will carry forward the hierarchical structure that has functioned through this reconsultation to have equal participation from the project management level, within the management structure, and from the regional executives of the three federal agencies and the ports. It is envisioned that this group will continue to function through the duration of the monitoring actions prescribed. The group will be the decision-making body to make modifications to project actions, compliance measures, the monitoring program, and research actions and ecosystem restoration features.

## ES.13 Formal Consultation

Through the BA consultation process, the Corps has determined that it is appropriate to request formal consultation for the 13 listed, one proposed, and one candidate salmonid populations and marine mammals discussed in this document. The Corps requests USFWS confirmation that the existing BO for

terrestrial species is still in effect and in addition, requests the Services' consultation and conference on the proposed action. Reasons for requesting formal consultation and conferencing follow:

- Although the dredging and disposal portion of the Project includes best management practices to address potential effects, the possibility remains that there may be some incidental take of species. Any incidental take, no matter how unlikely or small, would be an adverse effect that warrants formal consultation. In addition, it is important to engage in formal consultation that results in a biological opinion and a conference opinion that include incidental take statements that cover potential take.

- The BA identifies specific areas where there are uncertainties and risks. The conclusions regarding uncertainties and risks are based on the independent scientific review process and considerable discussion with the Services. The Corps believes that it is important for this information to be confirmed and for the commitments to monitoring and adaptive management to be reflected in a biological opinion.

- The Project includes an Ecosystem Restoration Component. This component includes activities that will have beneficial effects on listed species and their habitat and that will benefit a variety of terrestrial species. Through the consultation process, the Corps has added the restoration actions to the Project. Formal consultation allows the Services to review the proposed Ecosystem Restoration features.